Data Reconstructor Software Manual

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1 Introduction

DataReconstructor reads replay files created by *Exalt* and log files created by *Merlin+*. It reconstructs the data on the 1553 bus using the Excalibur board and *Galahad Software Tools*.

In addition there is a simultaneous monitoring and log file creation feature which enables the program to monitor the data transmitted on the 1553 bus during the reconstruction and retransmission of the data from the log file.

The *DataReconstructor* also includes the standard 1553 'retries' feature. If a message does not get a response from the RT, or gets a bad response, it tries again.

Important *DataReconstructor* now uses the EXC-1553PCI/P*x*'s and the M4K1553P*x*'s Internal Concurrent Monitor. The program does *not* require a separate channel/module.

This software is for use in a lab environment, to reconstruct a situation recorded in-flight or to do regression testing.

2 Overview

DataReconstructor supports the Excalibur 1553 PCI/P*x* boards and the M4K1553P*x* module on the EXC-4000PCI carrier board. Data may be reconstructed with a single P*x* channel or module. However, for monitoring data, the user must have a board or module with an internal Concurrent Monitor [-PM*x*].

The data file format is the same as the log files written either by *Exalt* or *Merlin+*. See **Section 4: File Formats** on page17.

2.1 Data Reconstruction from a Replay or Log File

The program reads replay files created by *Exalt* or a log files created by *Merlin+*, and reconstructs the data on the 1553 bus using the Excalibur board and *Galahad Software Tools*.

The user selects a file and "runs" it. *DataReconstructor* reconstructs and transmits the same data on the 1553 bus, so that if *Exalt* or *Merlin+* were again monitoring they will create the same file. There may be some differences in the actual transmission, depending which RT options and which transmission options were selected.

The data transmission will be synchronized based on the Time tags of the messages in the file – messages are sent out according to their Time tags. See **Transmission Options** on page 9 for *Exalt* files or page 15 for *Merlin+* files.

In addition the user defines for each RT:

- the retry options
- to simulate or not
- to enable (have its data transmitted on the 1553 bus) or to disable (so that messages in the file relevant to this RT are not transmitted)

For more details see **RT Setup options** on page 6 for *Exalt* files or page 13 for *Merlin+* files.

2.2 Retries

This is a standard 1553 feature and is supported by Excalibur boards. If a message does not get a response from the RT, or gets a bad response, the message is sent again.

The user selects the number of retries (between 0 and 3). When the BC gets a bad response from the RT, it will resend the message between 0 and 3 times, as selected by the user, on the same or alternate bus.

See **RT Setup options** on page 6 for *Exalt* files or page 13 for *Merlin*+ files.

3 Working with DataReconstructor

DataReconstructor reads *Exalt* replay files and *Merlin+* log files. Each 1553 bus used by *DataReconstructor* is assigned to a channel. In both modes:

- up to 8 channels can be active simultaneously
- the default is for channel 0 to be selected

In *Exalt* the data source is from the one input file and recorded to one output file, regardless of the number of active channels. Therefore, before transmitting data, each named module in the file must be mapped to a specified channel.

In *Merlin+* the data source and output is per channel. Therefore, before transmitting data, separate input and output files must be specified for each active channel.

Follow the setup procedure for either *Exalt* or *Merlin+* before beginning to transmit data.

Note: For ease of use, *DataReconstructor* uses the standard Windows keyboard conventions and shortcuts.

3.1 Transmitting Exalt Data Replay Files

To set up *DataReconstructor* to transmit data from *Exalt* replay files:

1. Run *DataReconstructor*, to display the main window.

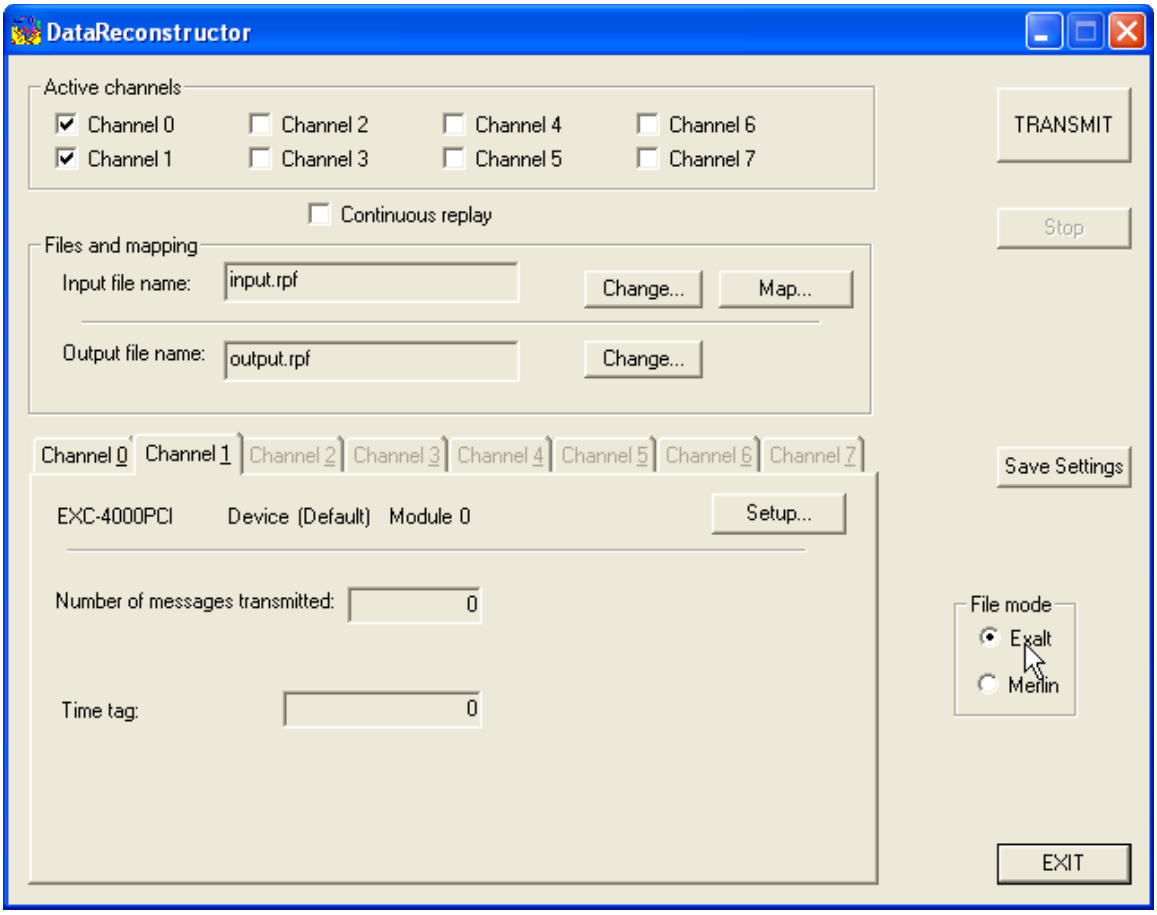

Figure 1 DataReconstructor main window: Exalt Data Replay Files

Note: The carrier board and module for each channel which has been set up to transmit data, is displayed on the channel tab page.

Figure 2 Board and Module for Each Active Channel

2. Select *Exalt* from the **File mode** dialog box, if it is not already selected.
3. From the **Active channels** dialog box, check the channels over which to transmit data. For each channel selected, a corresponding **Channel tab** is then available for setting up RTs, selecting the Excalibur board, choosing transmission and display options.

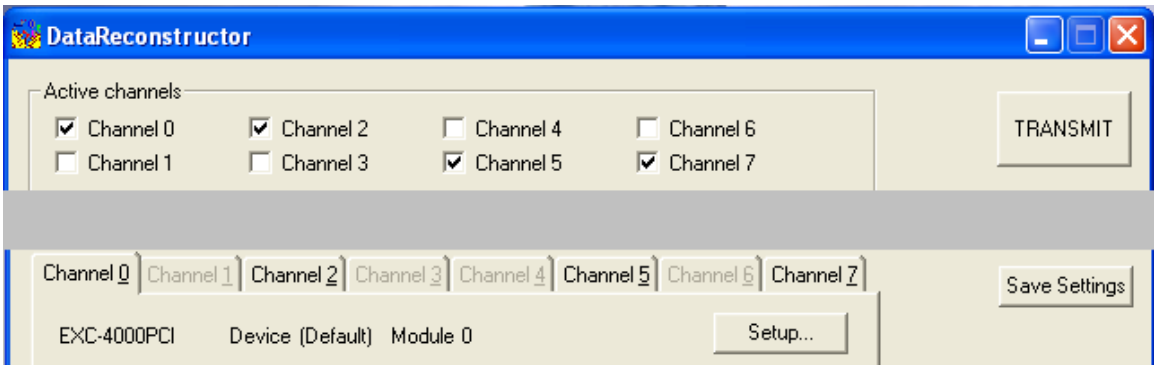

Figure 3 Exalt – Selecting buses over which to transmit data

4. To send out messages in a loop, check **Continuous replay**. The file runs continuously until the user clicks **Stop**.
5. Select an *Exalt* *.**rpf** input file. To run a different *.**rpf** file, click **Change**. Browse for the file.
6. Click **Map**, to display the **Map dialog box**.

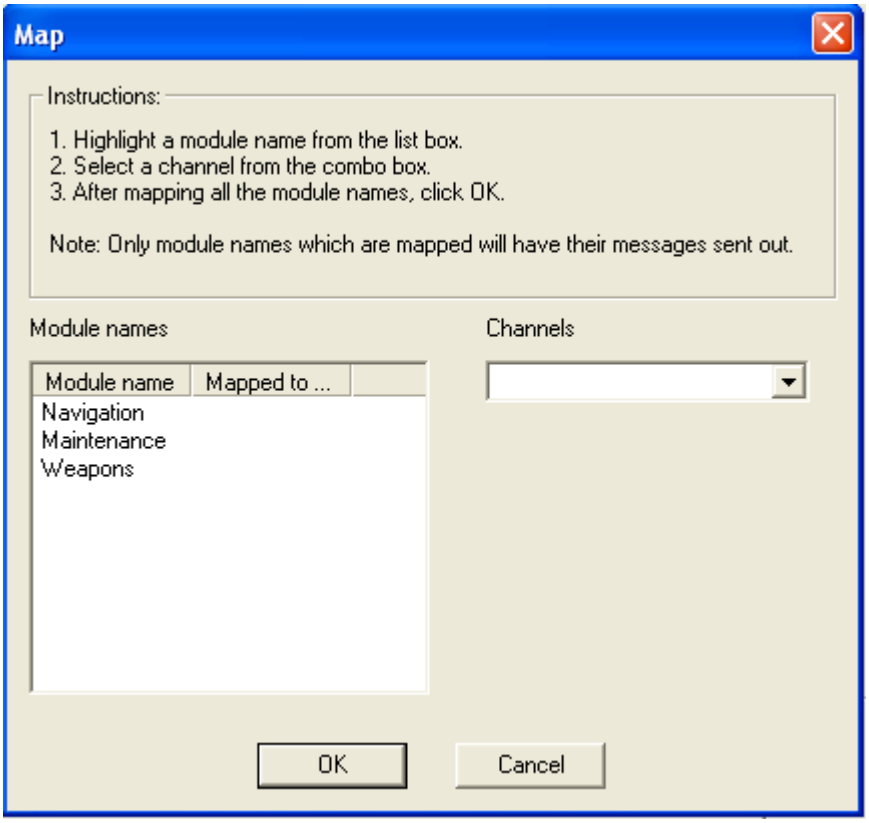

Figure 4 Map dialog box

To map a named module:

a. Highlight a module name from the **Module names** window.
b. Select a channel from the **Channels** combo box

After mapping all the named modules, click **OK**.

Note: Only mapped module names will have their messages transmitted. A named module may be mapped to an inactive channel, reserving the channel for transmitting a different reconstruction of the data file.

7. If at least one channel will be concurrently monitored, select an *Exalt* *.**rpf** output file. Click **Change** to select an output file.
8. For each channel activated in the **Active Channels** dialog box, set up the **RTs**, select the **Board Setup**, **Transmission** and **Display options**.

   Click the **Channel tab** and then **Setup**, to display the **Setup dialog box**.

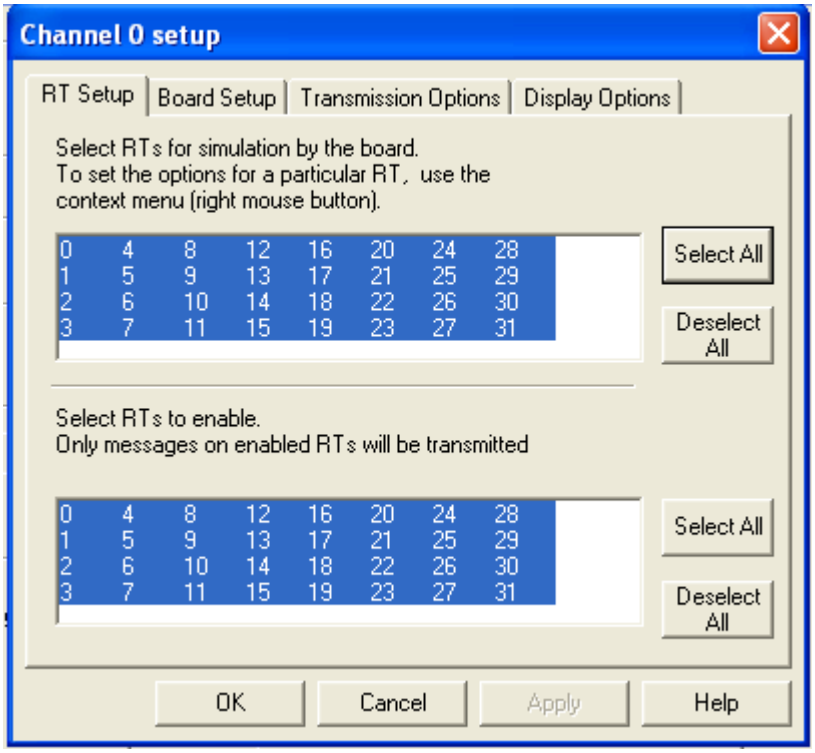
Channel 0 setup
RT Setup
Board Setup
Transmission Options
Display Options
Select RTs for simulation by the board.
To set the options for a particular RT, use the
context menu (right mouse button).
0 4 8 12 16 20 24 28
1 5 9 13 17 21 25 29
2 6 10 14 18 22 26 30
3 7 11 15 19 23 27 31
Select All
Deselect All
Select RTs to enable.
Only messages on enabled RTs will be transmitted
0 4 8 12 16 20 24 28
1 5 9 13 17 21 25 29
2 6 10 14 18 22 26 30
3 7 11 15 19 23 27 31
Select All
Deselect All
OK
Cancel
Apply
Help

Figure 5 Bus Setup

a. **RT Setup tab** allows the user to:

i Set up retry options per RT
ii Select RTs for simulation
iii Select which RTs will have their data transmitted

The default is:

- to transmit messages for all RTs
- no retries
- to simulate all RTs

Optional

i To set up retry options for selected RTs:

- In the **Select RTs for simulation by the board** window; right-click the selected **RT**, to display an **RT Options dialog box**.

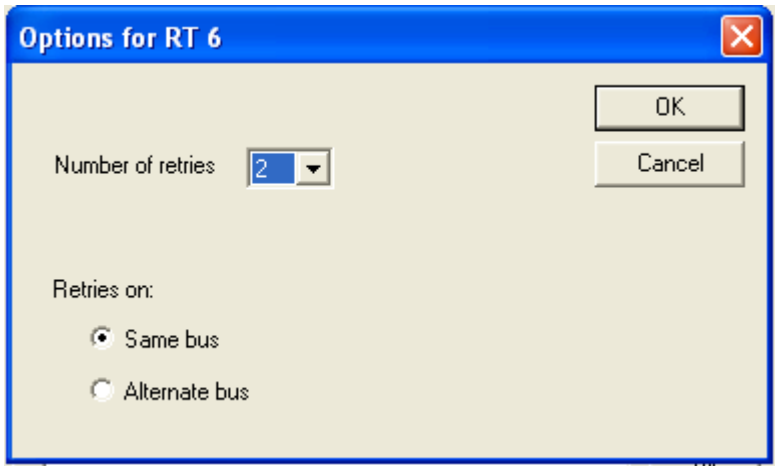

Figure 6 RT Retry options dialog box

- Select the number of retries from the combo box and whether the retries should be on the same bus or the alternate buses.
- Click **OK**, to return to the **RT setup** tab.

ii To select RTs for simulation, use the standard Windows mouse +[*Ctrl/Shift*] key combinations, in the **Select RTs for simulation by the board** window.

iii To enable selected RTs, use the standard Windows mouse + [*Ctrl/Shift*] key combinations, in the **Select RTs to enable** window.

b. **Board Setup** allows the user to select the board type, device number and module number.

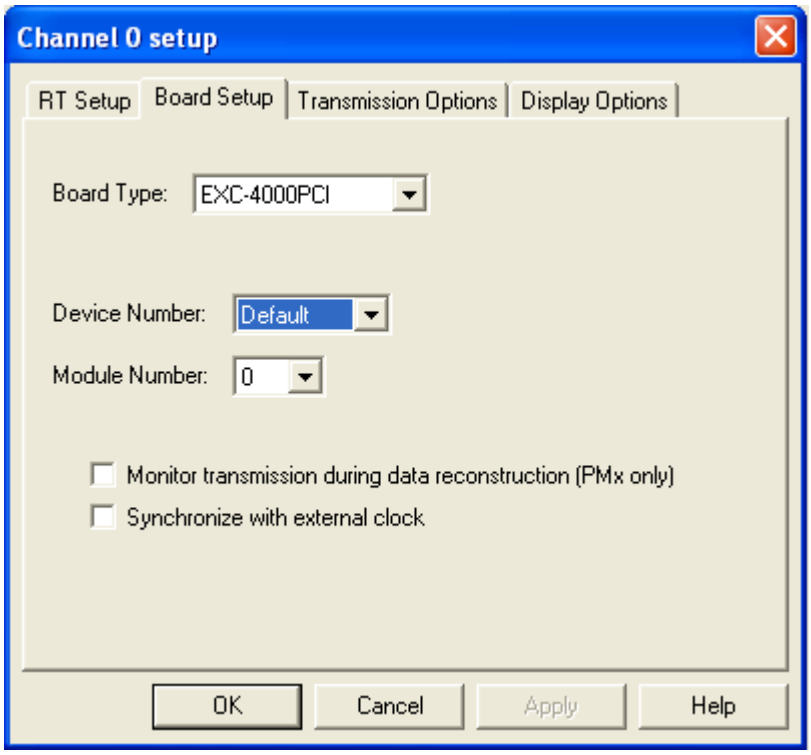

Figure 7 Board Setup

Note: For the **EXC-1553PCI/Px** leave the **Default Device Number** setting.

For the **EXC-4000PCI:**

- If there is only *one* board present, leave the **Default Device Number** setting.
- If you have *more than one* EXC-4000PCI board, for each board, enter the **Device Number** selected in the **`ExcConfig`** utility program.

In addition the user may also:

Select:	To:
Monitor the bus during data reconstruction	Enable concurrent monitoring and create a new file
Synchronize with external clock	Enable synchronization with an external clock source. For more details see the hardware *User's Manual.*

c. **Transmission Options** allows the user to set **Mode code subaddress** and **Broadcast** options.

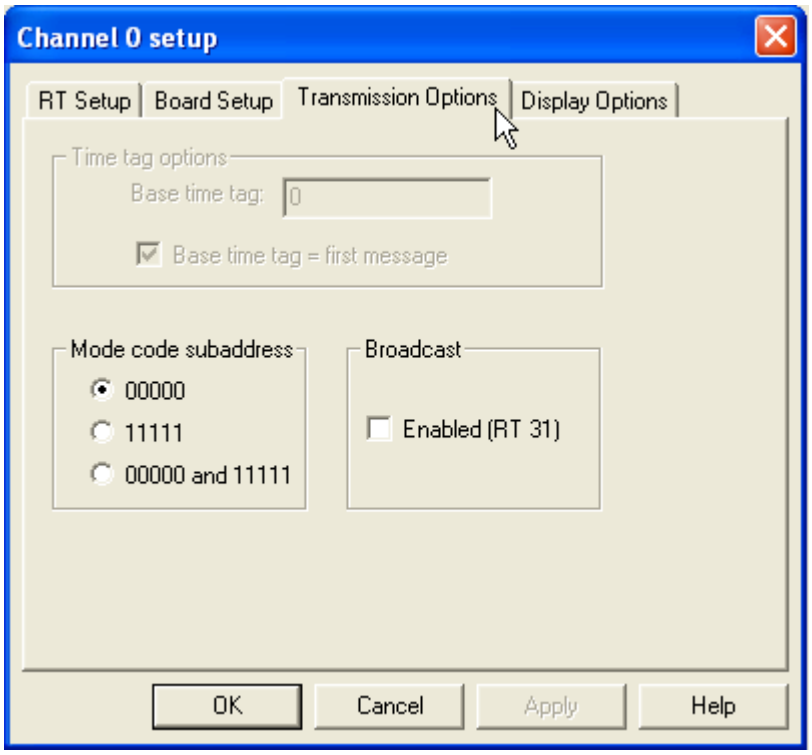

Figure 8 Transmission Options

Note: In *Exalt mode* the base Time tag is always the first message – messages always start going out immediately at zero time. The following messages go out at the appropriate times relative to the first message.

Mode Code Options

The board can be configured to allow either 00000 or 11111 or both, as possible Mode Code subaddresses (0 or 31).

Broadcast

To interpret messages to RT31 as broadcast messages, check the **Enabled (RT 31)** box.

d. **Display Options**, Number of messages transmitted and Time tag, if checked, are displayed and periodically updated as data is transmitted, in the *DataReconstructor* main screen.

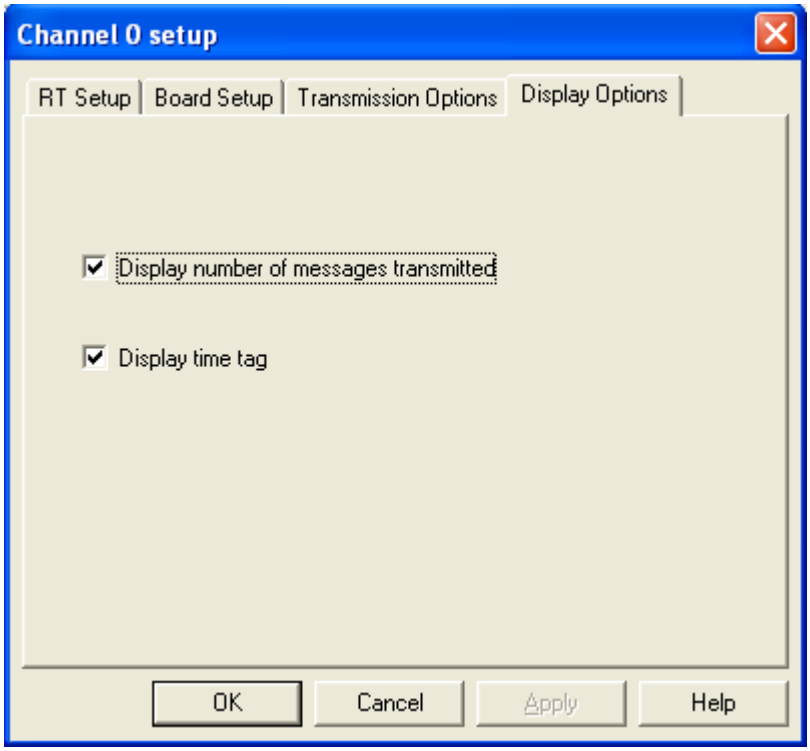

Figure 9 Display Options

9. Click **OK**, to return to the *DataReconstructor* main window.
10. Click **Save Settings**, to save the current settings. These are the settings which will be available the next time *DataReconstructor* is opened.
11. Click **Transmit**, to start transmitting the data from the replay file. The **Number of messages transmitted** and **Time tag** are updated periodically, for the currently displayed channel, if these options were set in the **Setup | Display options** dialog box.

    See **Figure 1: DataReconstructor main window: Exalt Data Replay Files** on page 3.
12. Click **Stop**, to stop transmission.

3.2 Transmitting Merlin+ Data Log Files

To set up *DataReconstructor* to transmit data from *Merlin+* log files:

1. Run *DataReconstructor*, to display the main window.

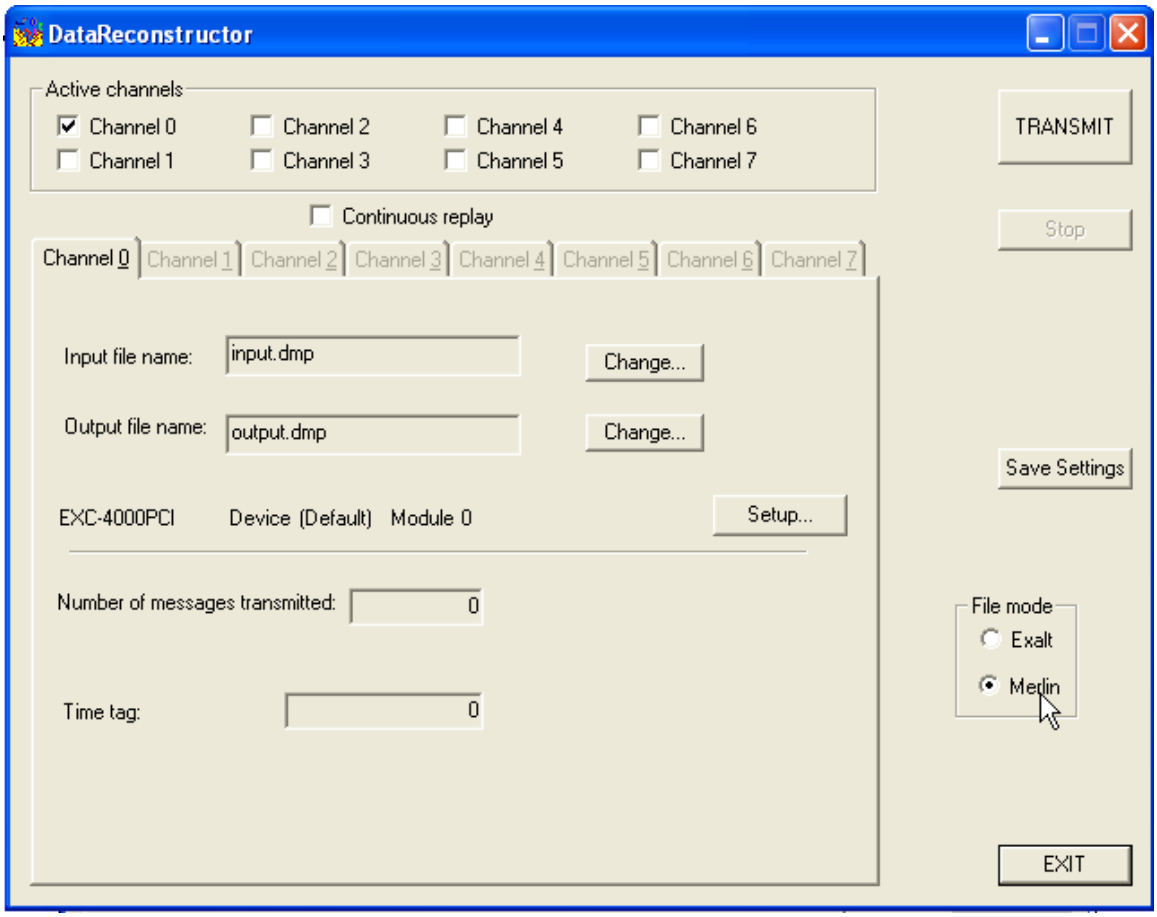

Figure 10 DataReconstructor main window: Merlin+ Data Log Files

Note: The carrier board and module for each channel which has been set up to transmit data, is displayed on the channel tab page.

Figure 11 Board and Module for Each Active Channel

2. Select *Merlin* from the **File mode** dialog box, if it is not already selected.

3. From the **Active channels** dialog box, check the channels over which to transmit data. For each channel selected, a corresponding **Channel tab** is then available for setting up RTs, selecting the Excalibur board, choosing transmission and display options.

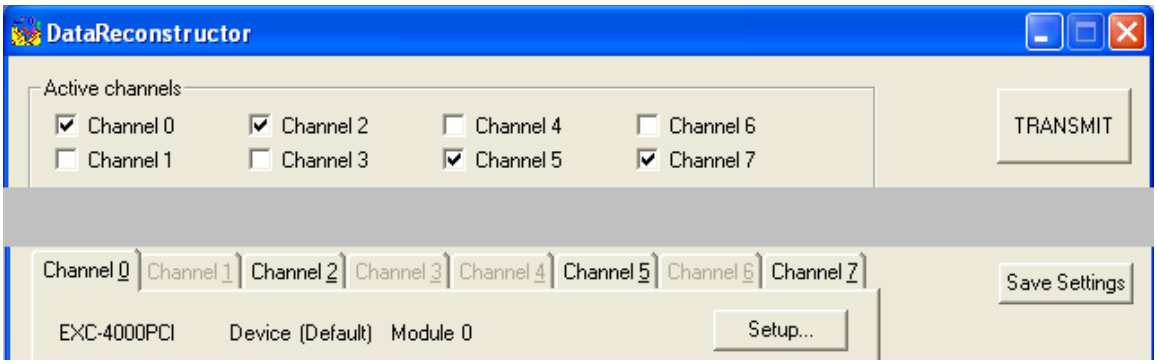

Figure 12 Selecting channels over which to transmit data

4. To send out messages in a loop, check **Continuous replay**. The file runs continuously until the user clicks **Stop**.

   For each channel activated in the **Active channels** dialog box:

5. Select a *Merlin+* ***.dmp** input file. To run a different ***.dmp** file, click **Change**. Browse for the file.
6. Select a *Merlin+* ***.dmp** output file. Click **Change** to select an output file.
7. Set up the **RTs**, select the **Board Setup**, **Transmission** and **Display options**.

   Click the **Channel tab** and then **Setup**, to display the **Setup dialog box**.

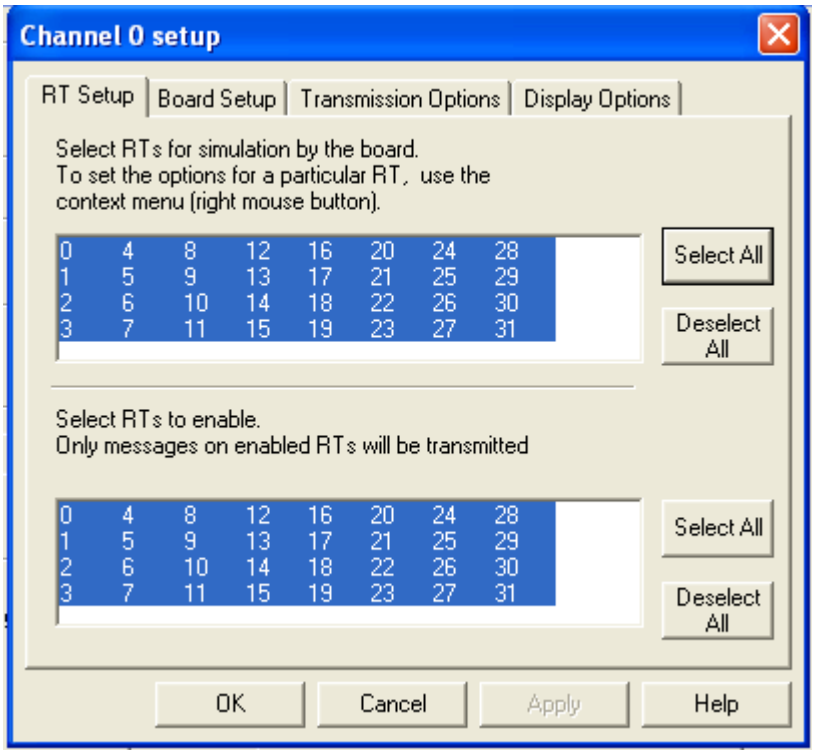
Channel 0 setup
RT Setup
Board Setup
Transmission Options
Display Options
Select RTs for simulation by the board.
To set the options for a particular RT, use the context menu (right mouse button).
0 4 8 12 16 20 24 28
1 5 9 13 17 21 25 29
2 6 10 14 18 22 26 30
3 7 11 15 19 23 27 31
Select All
Deselect All
Select RTs to enable.
Only messages on enabled RTs will be transmitted
0 4 8 12 16 20 24 28
1 5 9 13 17 21 25 29
2 6 10 14 18 22 26 30
3 7 11 15 19 23 27 31
Select All
Deselect All
OK
Cancel
Apply
Help

Figure 13 Bus Setup

a. **RT Setup tab** allows the user to:

i Set up retry options per RT
ii Select RTs to be simulated
iii Select which RTs will have their data transmitted

The default is:

- to transit messages for all RTs
- no retries
- to simulate all RTs

Optional

i To set up retry options for selected RTs:

- In the **Select RTs for simulation by the board** window; right-click the selected **RT**, to display an **RT Options dialog box**.

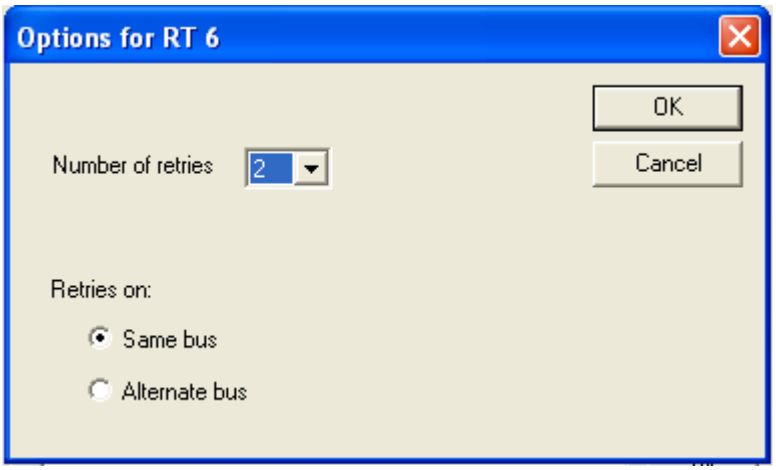

Figure 14 RT Retry options dialog box

- Select the number of retries from the combo box and whether the retries should be on the same bus or the alternate buses.
- Click **OK**, to return to the **RT setup** tab.

ii To select RTs for simulation, use the standard Windows mouse +[*Ctrl/Shift*] key combinations, in the **Select RTs for simulation by the board** window.

iii To enable selected RTs, use the standard Windows mouse + [*Ctrl/Shift*] key combinations, in the **Select RTs to enable** window.

b. **Board Setup** allows the user to select the board type, device number and module number.

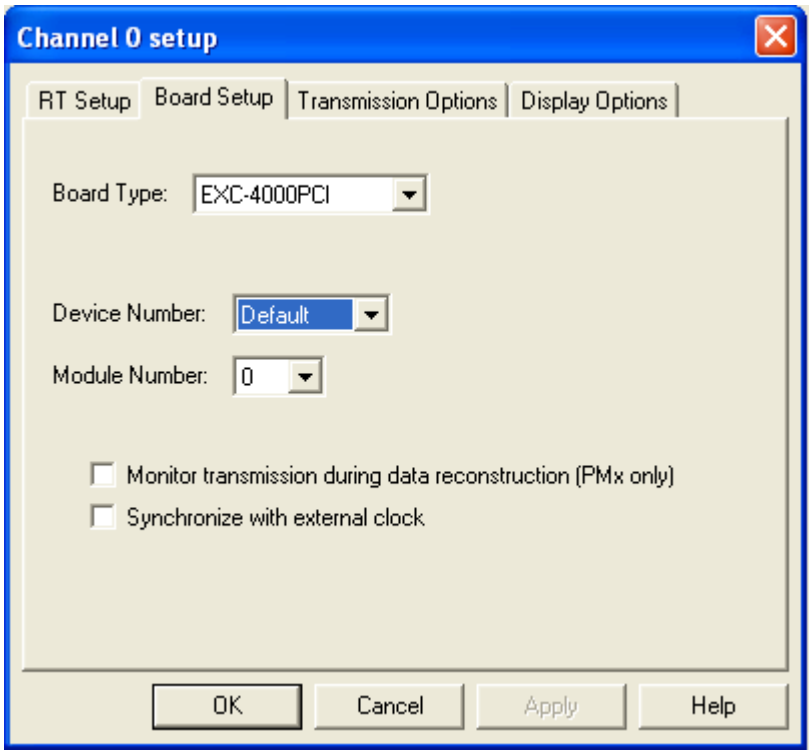

Figure 15 Board Setup

Note: For the **EXC-1553PCI/Px** leave the **Default Device Number** setting.

For the **EXC-4000PCI:**

- If there is only *one* board present, leave the **Default Device Number** setting.
- If you have *more than one* EXC-4000PCI board, for each board, enter the Device Number selected in the **`ExcConfig`** utility program.

In addition the user may also:

Select:	**To:**
Monitor the bus during data reconstruction	Enable concurrent monitoring and create a new file
Synchronize with external clock	Enable synchronization with an external clock source. For more details see the hardware *User's Manual.*

c. **Transmission Options** allows the user to set **Time tag**, **Mode code subaddress** and **Broadcast** options.

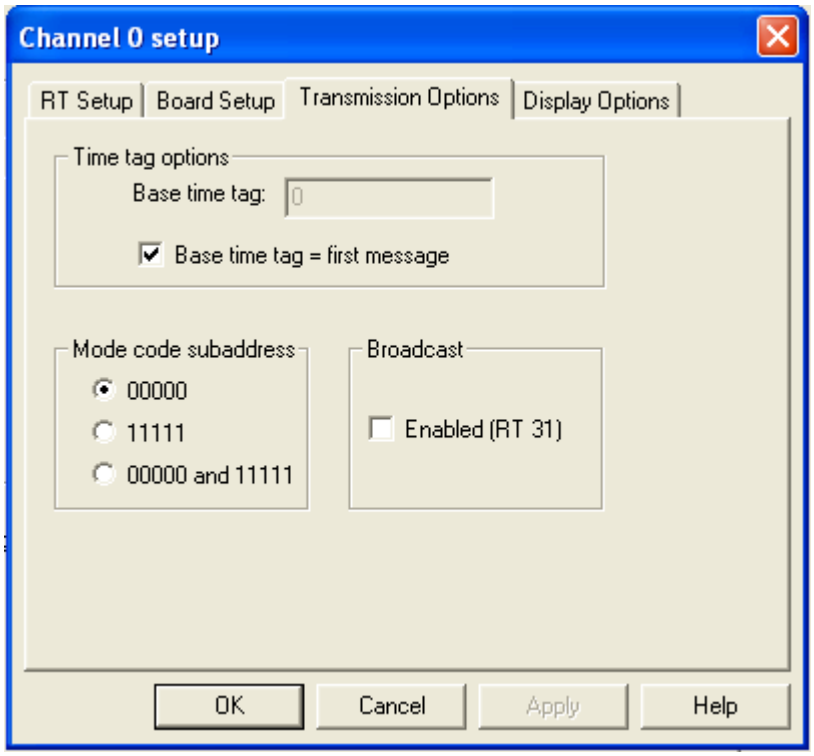

Figure 16 Transmission Options

Time tag options

i **Base time tag**: Enter a hexadecimal value. This value is subtracted from every message's time tag. If a message's time tag is smaller than this value, it will be set to zero.
Example: If the user enters 9, then a message with time tag 5 is sent out immediately, as if it had time tag 0. A message with a time tag 0×B will go out when the time tag reaches 2, etc.

ii **Base time tag = first message**: The time tag of the first message in the file is subtracted from all the time tags. The first message will go out immediately, zero time. The following messages go out at the appropriate times relative to the first message. [**Default setting**]

Mode Code Options

The board can be configured to allow either 00000 or 11111 or both, as possible Mode Code subaddresses (0 or 31).

Broadcast

To interpret messages to RT31 as broadcast messages, check the **Enabled (RT 31)** box.

d. **Display Options**, Number of messages and Time tags, if checked, are displayed and periodically updated as data is transmitted, in the *DataReconstructor* main screen.

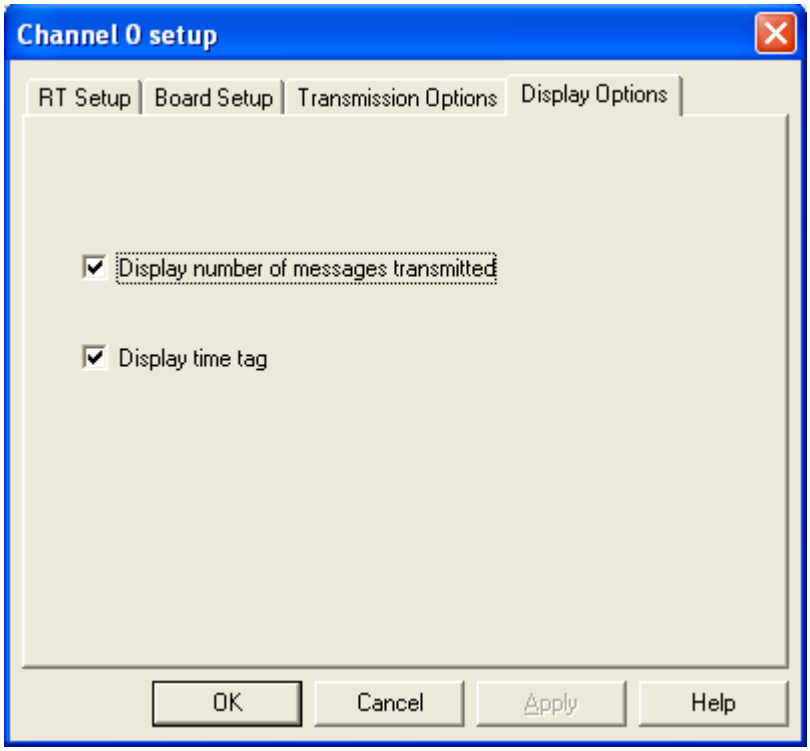

Figure 17 Display options

8. Click **OK**, to return to the *DataReconstructor* main window.
9. Click **Save Settings**, to save the current settings. These are the settings which will be available the next time *DataReconstructor* is opened.
10. Click **Transmit**, to start transmitting the data from the replay file. The **Number of messages transmitted** and **Time tag** are updated periodically if these options were set in the **Setup | Display options** dialog box.

    See **Figure 10: DataReconstructor main window: Merlin+ Data Log Files** on page 11.
11. Click **Stop**, to stop transmission.

4 File Formats

4.1 Exalt data file format, version 1.10

The data file is a binary format consisting of a header, a list of messages, and a footer. Each element is described below.

4.1.1 Header

Byte Offset	Content
0	“XCAL Replay file” + 9 periods
26	“Version 1.10”
38	Number of messages – unsigned int
42	Base date and time of file
46	System configuration (see below)
Following system configuration	Trigger list (see below)

4.1.2 System configuration

Byte Offset (from beginning of system configuration)	Content
0	Number of data streams – unsigned int
4	List of data streams (adapters) (see below for representation of an adapter)

4.1.3 Data stream (adapter)

Byte offset (from beginning of data stream)	Content
0	Number of characters in adapter name (adapNameSize) – int
4	Adapter name(adapNameSize bytes long)
4 + adapNameSize	Number of characters in adapter type name (adapTypeSize) – int
8 + adapNameSize	Adapter type name (adapTypeSize bytes long)
8 + adapNameSize + adapTypeSize	Adapter ID – unsigned short
10 + adapNameSize + adapTypeSize	Adapter version – unsigned short
12 + adapNameSize + adapTypeSize	Number of filter statuses – unsigned int
16 + adapNameSize + adapTypeSize	List of filter statuses (see below for representation of each filter status)

4.1.3.1 Filter Status

Byte offset (from beginning of filter status)	Content
0	Number of characters in full path (fullPathSize) – int
4	Full path (fullPathSize bytes long)
4 + fullPathSize	Status -- unsigned char (read as a bit field – bit one indicates that this element is filtered out, bit 2 indicates that this element is inactive)

4.1.4 Trigger list

This is a list of the triggers (conditions for starting/stopping recording) that were defined when this file was recorded.

Byte offset (from beginning of Trigger List)	Content
0	Number of triggers – int
4	List of triggers (see below for representation of each trigger)

4.1.4.1 Trigger

Byte offset (from beginning of trigger)	Content
0	Number of characters in expression string (expSize) – int
4	Expression string (expSize bytes long) (eg. EU1 + EU2 < 100)
4 + expSize	Type – enum (4 bytes) (0 = start trigger. 1 = start/stop trigger, 2 = stop trigger)
8 + expSize	Has been set – bool
9 + expSize	Is continuous – bool
10 + expSize	Is consecutive – bool
11 + expSize	Num required occurrences – int
15 + expSize	Max hits – int
19 + expSize	Is active – bool
20 + expSize	Pre trigger time – 64-bit integer
28 + expSize	Post trigger time – 64-bit integer
36 + expSize	Number of characters in name string (nameSize) – int
40 + expSize	Name (nameSize bytes long)
40 + expSize + nameSize	Unique ID – unsigned long

4.1.5 Messages

List of messages (see below for representation of each message)

Byte offset (from beginning of message)	Content
0	Adapter ID (unsigned short)
2	Time tag – 64-bit integer
10	Serial number – unsigned long
14	Message identifier – unsigned long
18	Flags (unsigned short) Bus-type specific information

4.1.5.1 1553 Bus-type specific information

Byte offset (from beginning of message)	Content
20	Command word – unsigned short
22	Second command word – unsigned short
24	Status word – unsigned short
26	Second status word – unsigned short
28	Px status – unsigned short
30	Number of bytes of data which follow
34	Data bytes
34 + 2 * numDataBytes	1553 additional flags – unsigned short

4.1.5.2 429 Bus-type specific information

Byte offset (from beginning of message)	Content
20	Data – unsigned long
24	Status – unsigned long
28	429 additional flags – unsigned short

4.1.5.3 Multipes Bus-type specific information

Byte offset (from beginning of message)	Content
20	Number of bytes of data which follow
24	Data bytes

4.1.6 Footer

Byte offset (from beginning of footer)	Content
0	Gap list
immediately following gap list	Mark list

4.1.7 Gap List

This is a list of recording gaps – times during the recording session when recording was turned off or was unsuccessful (for example, if the system was overloaded and could not keep up).

Byte offset (from beginning of gap list)	Content
0	Number of gaps – unsigned int
4	List of gaps

4.1.7.1 Gap

Byte offset (from beginning of gap)	Content
0	Time tag before gap – 64-bit integer
8	Serial number before gap – unsigned int
12	Time tag after gap – 64-bit integer
20	Serial number after gap – unsigned int
24	Type – int

4.1.8 Mark list

The list of points in the file which were labeled as significant points to which one may want to return when analyzing the file – like bookmarks.

Byte offset (from beginning of mark list)	Content
0	Number of marks – unsigned int
4	List of marks

4.1.8.1 Mark

Byte offset (from beginning of mark)	Content
0	Time tag – 64-bit integer
8	Serial number – unsigned int
12	Number of characters in name (numNameChars) – int
16	Name (numNameChars characters)
16 + numNameChars	Number of characters in description (numDescChars) – int
20 + numNameChars	Description (numDescChars characters)

4.2 Merlin+ log Files

The data log files are identical to the data files used by *Merlin+*. This file format will be both written and read by this program.

It is a binary file beginning with 100 16-bit values of data. The first 7 16-bit values contain the ASCII values of 'M' 'E' 'R' 'L' 'I' 'N' '+'. The first 16-bit value after is a version number. The files exported by *Merlin+* are **version 1**; files exported by *Data Reconstructor* are **version 2**.

In **version 2** the "filler value" described below is the next 16-bit value in the header. In **version 1** the next header 16-bit value is set to one. The remaining header 16-bit values contain a value of one.

After the header, the messages are recorded as follows:

- Size
- Spare 16-bit value (set to filler value of 0×69)
- Message status
- Time Tag lo
- Time Tag hi
- (Up to) 36 Words of actual bus data

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